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Shinya Yamanaka, Director, Center for iPS Cell Research and Application, Kyoto University.

Induced pluripotent stem cells (iPSCs) offer exciting potential for next-generation medicine. Since its invention in 2006 by Shinya Yamanaka and his team at Kyoto University, iPSC technology and research have been advanced by the university's Center for iPS Cell Research and Application (CiRA), which in 2015 entered a large-scale research partnership with Takeda Pharmaceutical Company to form the Takeda-CiRA Joint Program for iPS Cell Applications (T-CiRA). Here Shinya Yamanaka, CiRA director and Nobel laureate, talks about the significance of the T-CiRA program and the prospects for its research.

Q: What are iPSCs and why are they important?

iPSCs are created by reprogramming somatic cells taken from adults, and are similar to embryonic stem cells. iPSCs can differentiate into any type of cell in the body, making them very promising for regenerative medicine as well as drug discovery for a wide range of conditions including rare and intractable diseases. Our technology for generating human iPSCs is safe, highly reproducible and simple, which allows us to produce a steady supply of stem cells for research and clinical applications.

Q: What can we expect from the T-CiRA program?

As the world's foremost research centre for iPSC technology, the CiRA's overarching mission is to develop clinical applications for iPSCs. To achieve this, collaborating with pharmaceutical companies is vital, and Takeda is Japan's largest pharmaceutical company. The T-CiRA program is an unprecedented collaboration between academia and industry in Japan in terms of both scale and level of cooperation. The collaboration is massive: over 6,000 m² of dedicated space and 20 billion yen of joint funding are dedicated to this project for the next 10 years, showing the degree to which Takeda believes in the potential of our iPSC technology. Also, the direction of collaboration is the opposite to that of conventional joint research, in which researchers from pharmaceutical companies come to a university to work with academic

researchers. Under the T-CiRA program, our CiRA researchers will go to Takeda's Shonan Research Center in Kanagawa, near Tokyo, to form teams with Takeda researchers. The T-CiRA program is therefore an exceptional collaboration, both in Japan and globally, from which we expect to see some very important advances in clinical iPSC cell technologies.

“ Much of our research is fundamental in nature but with important future applications in mind. ”

Q: How will the T-CiRA collaboration facilitate research?

The T-CiRA program represents a rare opportunity for researchers to commit to a project continuously for as long as 10 years. That will allow us to greatly advance the research overall, as the type of breakthrough projects we are undertaking often require a significant amount of time to produce results. Becoming an on-site collaborator with a large pharmaceutical company like Takeda also affords full access to a range of excellent resources that are important for drug discovery, including research facilities, equipment and access to a huge compound library, as well as interactions with experts in a wide variety of fields, including high-throughput screening and medicinal chemistry. It's a wonderful opportunity for any researcher.

Q: What kind of research is being pursued under the T-CiRA program?

As of April 2016, we have had seven research projects in full swing. Two projects are in regenerative medicine; one is looking at the development of cell therapy for type 1 diabetes based on the transplantation of iPSC-derived pancreatic cells and the other is investigating an immune-cell therapy for various cancers using cancer-specific lymphocytes derived from iPSCs. T-CiRA researchers are also working hard to develop drugs for intractable diseases. One research group is aiming to discover new drugs for amyotrophic lateral sclerosis (ALS), a fatal neurodegenerative disease, using iPSCs created from the patient's own cells. Another group is

tackling muscular diseases such as muscular dystrophy and myopathy.

Much of our research is fundamental in nature but with important future applications in mind. For example, a fifth team is working on a next-generation platform for drug discovery using iPSC-derived heart muscle cells with future outlook toward treatments for heart failure, and a sixth team is looking to generate neural crest stem cells from iPSCs for use in various types of research for drug discovery and regenerative medicine.

We have also recently added a seventh project involving specialists in genome editing to develop novel therapy for Duchenne muscular dystrophy.

For some of the more advanced projects, like those investigating type 1 diabetes and cancer immunotherapies, our goal is to begin clinical trials within several years. For the other more fundamental projects, we expect to see at the end of the initial 10-year program progress towards relevant approvals from regulators, such as the FDA and Pharmaceuticals and Medical Devices Agency (Japan) for new therapeutics. In particular, we hope that these new technologies will lead to drugs that will be accessible to patients soon after.

Q: Are there opportunities for other researchers under the T-CiRA program?

Our project leaders are independently responsible for recruiting researchers, and we welcome interest from any researcher who would like to get involved in developing medical applications using iPSC technology. We currently have about 50 researchers assigned to our existing projects, including researchers from Takeda, but we would like to increase that number to about 100 researchers as quickly as possible.

Overall, we would like to recruit researchers with clever approaches to study diseases that could be addressed using iPSC technology. In addition to the aforementioned 7 projects, the technology could be used to develop novel treatments for many other diseases, such as hematologic and immune diseases, neuropsychiatric disorders and various genetic diseases. The T-CiRA program is a rare opportunity, as it is based on a new research framework, and we would like scientists from all backgrounds to join us on this journey.

Positions Available at T-CiRA Joint Program



Open positions:

- 1) Principal Investigators
Professor
Associate Professor
Junior Associate Professor
Assistant Professor
- 2) Staff scientists working on individual projects
- 3) Post-doctoral fellows working on individual projects

Work location:

Shonan Research Center, Takeda Pharmaceutical Company, Fujisawa City, Kanagawa, Japan (CiRA Satellite Lab)
Employment is thorough Kyoto University.

For further details:

<http://www.cira.kyoto-u.ac.jp/e/employment/>
<http://www.takeda.com/t-cira/>



